PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:	WO 93/10860
A62C 35/58	A1	(43) International Publication Date:	10 June 1993 (10.06.93)

(21) International Application Number: PCT/FI92/00316

(22) International Filing Date: 25 November 1992 (25.11.92)

(30) Priority data:
915575 26 November 1991 (26.11.91) FI
915669 29 November 1991 (29.11.91) FI

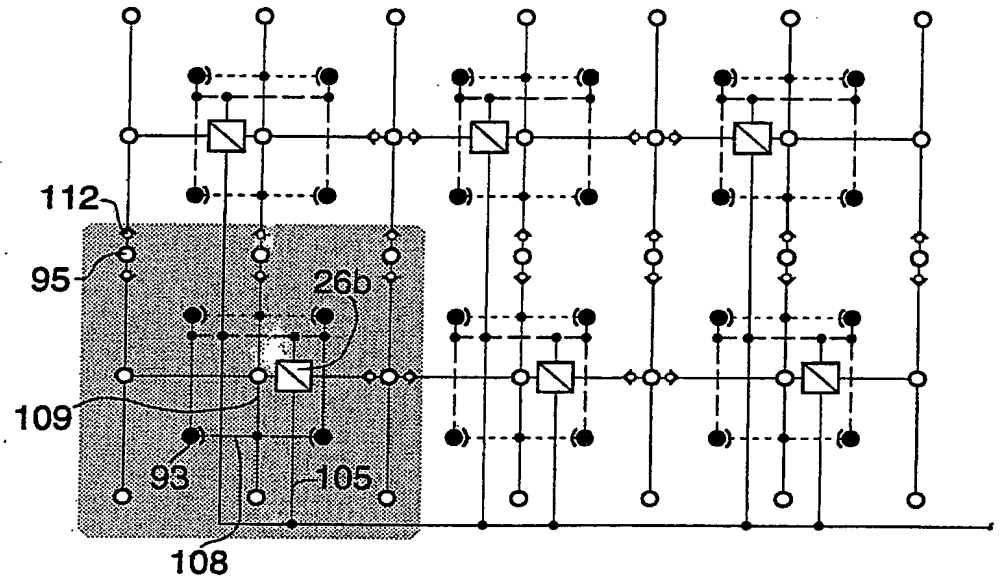
(71)(72) Applicant and Inventor: SUNDHOLM, Göran [FI/FI]; Ilmari Kiannon kuja 3, SF-04310 Tuusula (FI).

(74) Agent: VALROS, Frey; Marioff Ky, PB 25, SF-01511 Vantaa (FI).

(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CS, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, PL, RO, RU, SD, SE, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).

Published
With international search report.

(54) Title: INSTALLATION FOR FIGHTING FIRE



(57) Abstract

The invention relates to an installation for fighting fire, e.g. in public spaces, such as restaurant rooms. In order to cover a relatively large area, releasing spray heads (93) are each arranged to distribute extinguishing liquid to a number of surrounding spray heads (95).

BEST AVAILABLE COPY

EE78 4.0.98 589 US

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria
AU	Australia
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CS	Czechoslovakia
CZ	Czech Republic
DE	Germany
DK	Denmark
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IT	Italy
JP	Japan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakhstan
LI	Liechtenstein
LK	Sri Lanka
LU	Luxembourg
MC	Monaco
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SK	Slovak Republic
SN	Senegal
SU	Soviet Union
TD	Chad
TG	Togo
UA	Ukraine
US	United States of America
VN	Viet Nam

Installation for fighting fire

The present invention relates to an installation for fighting fire, with at least one releasing means reacting under the influence of an indication of fire, to initiate a fire extinguishing process.

In known equipment of this kind, especially in public spaces, such as restaurants, that particular individual sprinkler, the release ampoule or the like of which becomes under influence of hot air or smoke, has been activated. It has hereby been presumed that hot air or smoke rises practically in the vertical direction.

In reality, e.g. ventilation causes the hot air or the smoke to move obliquely upwards, for which reason often such a sprinkler which is not positioned right above the fire, has been activated. An active sprinkler in "wrong" position may lead to a general cooling in the room, with the result that the "correctly" positioned sprinkler above the fire remains inactive in spite of the fire developing.

One object of the present invention is to provide a new fire-fighting istallation which eliminates the said problem.

The equipment according to the present invention is mainly characterized in that said releasing means is arranged to activate a group of spray heads.

In a preferred emodiment of the invention, said group of spray heads forms a part of a larger system of individually activatable spray head groups. Preferably the groups of spray heads are aranged to overlap each other by means of the respective border spray heads which are activatable alternatively within either respective group. This can be achieved e.g. by means of check valves at the border spray heads, which valves prevent extinguishing liquid from flowing from

an activated group of spray heads to an inactivated group of spray heads.

The groups of spray heads can be positioned near or at the ceiling of a restaurant room, whereat one or several releasing spray heads can be provided for each group of spray heads and the releasing spray head or heads are preferably arranged to distribute extinguishing liquid directly to the other spray heads in the respective group.

The spray heads, their individual nozzles and the mutual arrangement of the nozzles are preferably made according to what is presented in the international patent applications PCT/FI92/00060, PCT/FI92/00155 and PCT/FI92/00156, to produce a fog-like spray of a high operating pressure and having a good penetration power.

By a fog-like spray is meant a spray of small droplets having a diameter typically 30 to 100 microns and preferably set in a strong whirling motion. By a high operating pressure is here in general meant from about 100 bar up to about 300 bar, as compared to an operating pressure of generally 2 to 10 bar in conventional sprinkler installations, which produce a rain-like spray. It shall ne noted, however, that the values given above are not absolute; definite limiting values are difficult to present.

One important advantage of a fog-like spray in connection with a so-called group activation, as here presented, is that a curtain effect is obtained, i.e. that the area and space covered by an activated group of spray heads will be separated from the rest of the larger space, so that most of the fog-like spray remains in the fire area. Further, that air which is sucked into the fire from the sides brings "fog" into the fire, and the smoke generated by the fire becomes at least partially washed.

In a further preferred embodiment of the invention, at least one release means is positioned in an upper region of the respective space and at least one spray head governed by the release means is positioned in the floor or in a wall of the respective space. Especially in this embodiment, the release means may, instead of a spray head, be e.g. a smoke detector which gives a signal to e.g. a solenoid valve which in turn activates a group of spray heads. Thus, the extinguishing liquid need not necessarily be distributed through the respective group of spray heads through the release means itself, such as a spray head, but electrical or electronical known activating equipment may be employed, alternatively.

A release spray head can be arranged to distribute extinguishing liquid to one or a group of secondary spray heads directly or indirectly, through a guide or governor valve. Preferred embodiments of such valves are defined in claims 9-12.

The invention shall in the following be described in more detail, with reference to exemplifying preferred embodiments shown in the attached drawing.

Figure 1 shows an example of an arrangement of spray heads in a ceiling of a relatively large space, e.g. a restaurant room, seen from above.

Figure 2 is a side view of the same space.

Figure 3 shows a longitudinal section of a release spray head, suitable for use in the arrangement of figures 1 and 2.

Figure 4 shows an example of an arrangement of spray heads in the ceiling and in the floor of a smaller room, such as a computer room, seen from above.

Figure 5 is a side view of the room of figure 4.

Figure 6 shows a longitudinal section of a first

embodiment of a guide valve, in inactivated state, suitable for use e.g. in the arrangement of figures 4 and 5.

Figure 7 shows the same valve in activated state.

Figure 8 shows a longitudinal section of a second embodiment of a guide valve, in inactivated state, suitable for use e.g. in the arrangement of figures 4 and 5.

Figure 9 shows the valve of figure 8 in activated state.

Figure 10 is an end view of the valve of figures 8 and 9.

Figure 11 illustrates the operating principle of the guide valve of figures 8-10, for a group of spray heads.

Figure 12 shows the spray head group of figure 11 in relation to a larger installation.

Figure 13 shows a longitudinal section of a release spray head suitable for use e.g. in the arrangements of figures 4 and 5 and of figures 11 and 12.

In figures 1 and 2, the reference numeral 1 indicates a space, such as a restaurant room. The reference numeral 2 indicates the floor of the space, in figure 2.

A number of releasing, or activating or governing spray heads are designated 3 and each such spray head 3 is in connection with e.g. four surrounding spray heads 4, through conduits 5.The releasing spray heads 3 can also be called primary spray heads, whereas the spray heads 4 can be called secondary spray heads. In the connections 5 between such secondary spray heads 4 which are connected to more than one activating spray head 3, is arranged a check valve 6, respectively. The spray heads 3 and 4

are preferably positioned in the ceiling of the room, as shown in figure 2.

When an activating spray head 3 has been released because of a fire nearby, a high pressure pump unit 7 drives liquid via a main line 8 and the respective feed line 10, including a governor valve 9, to the respective released spray head 3 and from that further to four surrounding secondary spray heads 4, in the embodiment of figure 1. One released spray head 3 thus effects extinguishing within a relatively large surrounding area. The check valves 6 prevent the exinguishing liquid from spreading to spray heads 4 belonging to a neihgbouring group.

A preferred embodiment of a release spray head 3, positioned in the ceiling 1 in figure 1, is shown in figure 3. Reference numeral 10 indicates a liquid inlet and connections to secondary spray heads 4 are indicated by 5. A release ampoule is indicated by 12.

The spray head 3 is preferably of a structure described in the international patent application PCT/FI92/00060 (WO 92/15370), with a spring loaded axially movable spindle 13 having an axial channel 14 in connection with an annular space 15 with an axial, pressure compensating end surface 16 which makes it possible to utilize a drive pressure of extraordinary magnitude, even up to about 300 bar, in the installation.

Figure 3 shows the spray head in an inactivated state of rest. Upon the ampoule 12 being released, e.g. by melting or crushing, the spring 17 presses the spindle 13 downwards in the figure, whereat connection is opened from the inlet 10 to the conduits 5 and to the obliquely downwards directed nozzles 18 of the spray head 3. The nozzles 18 are preferably of a structure and in a mutual arrangemnt as described in the international patent applications PCT/FI92/00155

and PCT/FI92/00156. The secondary spay heads are preferably of the same kind but need no spindle like the activating spray head 3.

In addition to, or instead of the secondary spray heads 4 positioned in the ceiling, spray heads can be positioned in the floor. Such floor spray heads are preferably of the kind described in the international patent application PCT/FI92/00213. The releasing and activating spray heads 3 can hereby be replaced by release means only, which govern valves for the floor spray heads.

A preferred embodiment of the foregoing alternative arrangement is shown in figures 4 and 5, where the reference numeral 21 indicates a relatively small room, such as a computer room. Spray heads at the ceiling are indicated by 22 and spray heads positioned in the floor are indicated by 23.

In computer rooms it is of advantage to place necessary, often extensive cable bundles in a channel under the floor. Such a channel is indicated by 21a in figure 5. As suggested in the patent application PCT/FI92/00213, the spray heads 23 are preferably arranged to spray a water fog into the cable channel 21a as well, to ensure that a fire does not spread through the channel and is not capable of damaging cables placed in the channel. A similar channel, e.g. for ventilation, is often present in the ceiling, as indicated by 21b, and the releasing spray heads 22 are preferably made to deliver liquid to spray heads 22a in the channel 21b.

A pump unit for extinguishing liquid is indicated by 24, the outgoing main line thereof is indicated by 25, and individually operable guide valves are indicated by 26. The guide valves can be incorporated in blocks 27. Feed lines to the ceiling spray heads 22 and to the floor spray heads 23 are

indicated by 28 and 29, respectively. The reference numeral 30 indicates check valves like the valves 6 in figure 1.

Figures 6 and 7 show a first embodiment of a guide valve 26a in detail. The valve comprises a body 31 with an inlet head 32 from the pump main line 25 and an outlet head 34 mounted in the opposite end, leading to a primary, activating spray head, and with an outlet 35, near the inlet 32, to secondary spray heads.

A spindle 36 is slidably arranged in the valve body 31, one end portion of the spindle extending into the inlet head 32 and the other end portion extending into the outlet head 33. Spindle seals in relation to the inlet head 32 and in relation to the outlet head 33 are indicated by 37 and 38, respectively. The spindle 36 has a piston 39 approximately at its mid-portion, with a seal 40 against the valve body 31. Between the spindle piston 39 and the outlet head 33 is arranged a spring 41, the spring space 42 being in connection to the atmosphere through at least one bore 43 in the wall of the valve body near the inner end of the head 33. an axial channel 44 extends from end to end through the spindle 36 and the end surfaces 45 and 46 of the spindle are of equal area.

In the axial channel 44 is arranged a check valve 47 with a small axial aperture 48, a spring 49 and a seal 50.

Figure 6 shows the guide valve in inactivated state. The inlet 32, the outlet 34 to at least one closed primary spray head and the axial channel 44 of the spindle 36 are filled with liquid. Since the end faces 45 and 46 of the spindle have equal areas, the forces acting on the end faces due to the liquid pressure are in balance and the spring 41 presses the piston 39 rightwards in figure 6, with the spindle end

to abutment against a stop 51 at the inlet 32. There is no connection from the inlet 32 to the outlet 35 leading to secondary spray heads.

When a primary spray head, connected to the outlet 34, is released, a liquid flow under high pressure starts through the valve and thereby through the axial channel 44, including the check valve 47. The pressure fall over the check valve 47, especially over the aperture 48 to begin with, and over the spindle 36 on the whole is great enough to force the spindle 36 to the position shown in figure 7, with the end face 45 against a stop 52 in the head 33 near the outlet 34 and open a diect connection from the inlet 32 to the outlet 35, as indicated by arrow 53. With this connection open, the liquid pressure acts on the end face 54 of the piston 39 and ensures that the spindle remains in the position of figure 7.

Figures 8-10 show a second, preferred embodiment of a guide valve 26b in detail. The valve comprises a body 61 with an inlet 62 from the pump main line and with a head 63 mounted in the opposite end, forming an outlet 64 leading to a primary, activating spray head, and with two outlets 65 and 66, near the inlet 62, to secondary spray heads.

A spindle 67 is slidably arranged in the valve body 61, one end portion of the spindle extending into the head 63. Spindle seals in relation to the inlet portion of the valve body 61 and in relation to the head 63 are indicated by 68 and 69, respectively. The spindle 67 has a piston 70 approximately at its mid-portion, with a seal 71 against the valve body 61. Between the spindle piston 70 and the head 63 is arranged a spring 72, the spring space 73 being in connection to the atmosphere through at least one bore 74 in the wall of the valve body near the inner end of the head 63. An axial channel 75 extends the from end

to end through the spindle 67 and the end surfaces 76 and 77 the spindle are of eq area.

re 8 shows the guic e in inactivated state. inlet 62, the outl to at least one closed ary spray head and t l channel 75 of the sp 7 are filled with l Since the end faces 7 77 of e spindle ha al areas, the rces j on t end faces the liquid essure n bal e and the spr 72 presses the piston 7 st a stop 78 near the outlets 65 and 66 to seconc ray heads. There is no connection from the "wet" 62 to the outlets 65 and 66 which are "dry".

When ast one primary spray head, connected to the outl , is released, a forceful liquid flow starts thro he valve and thereby through the axial channel 75 he spindle 67. The channel 75 can be made so narr that the pressure fall from end to end is great enough to force the spindle 67 to the position shown in figure 9 with the end face 76 against a stop 79 in the head 63 near the outlet 64 and open direct connections from the inlet 62 to the outlets 65 and 66, as indicated by arrows 80.

In a preferred embodiment, a branch line is connected from the respective primary spray head to either one of the "dry" outlets 65 and 66. When the primary spray head is released, pressurized liquid flows through the branch line to act on the annular end 81 of the piston 70, facing to the right in figures 9 and 10, with a great force. The pressure fall over the spindle 67 is then of little importance, i.e. the channel 75 can be made wider and a stronger spring 72 can be used.

Figure 11 illustrates one example of this preferred embodiment.

In figure 11, one guide valve 26b serves four

primary spray heads 91-94, connected to the "wet" outlet 64 of the valve 26b, and nine secondary spray heads 95-103 connected to the "dry" outlets 65 and 66 of the valve 26b.

It is now assumed, that the primary spray head 93 is activated, i.e. its release ampoule, or bulb 104 is released under the influence of e.g. hot air rising from a fire seat. Liquid under a high pressure starts flowing from the pump feed line 105 through the valve inlet 62, the axial channel 75 of the spindle 67 therein, the outlet 64 and the lines 106 and 107 to the primary spray head 93. A part of the liquid flows further through a branch line 108, connected to the primary spray head 93, and through the lines 109 and 110 to the formerly "dry" outlet 66 and presses the spindle 67 of the valve 26b to the position shown in figure 10. Thereafter liquid under high pressure flows diectly from the pump feed line 105 through the outlets 65 and 66 and the lines 110 and 111 to all secondary spray heads 95-103.

The function is the same if two or more primary spray heads are activated. The activating liquid flow from the primary spray head 93 to the guide valve 26b also goes to the secondary spray heads but the flow resistance of these are much greater than the flow resistance in the path to the valve 26b. Check valves 112 cut the connections from the secondary spray heads 95, 98, 101 and 102 to adjacent similar groups of spray heads.

The spray head group shown in figure 11 is preferably a part of a larger system, e.g. in the way shown in figure 12, where the area covered by the group of figure 11 is indicated by grey colour. The reference numerals in figure 12 indicate the same as in figure 11. Figure 11 may give the impression that e.g. the spray heads 95, 96 and 97 are positioned

above each other; the spray heads have been drawn in this direction for the purpose of showing the general structure of the spray heads, only, in reality they are directed into t drawing plane, as will be understood from figure 12 also. The spray heads 95-103, or some of them, may of course alternatively be positioned in a floor.

As earlier mentioned, the primary spray heads are preferably made as presented in the international patent application PCT/FI92/00060 and both the primary spray heads and the secondary spray heads are preferably made as presented in the international patent applications PCT/FI92/00155 and PCT/FI92/00 to produce fog-like sprays with a good penetration power.

A spray head group like the one shown in figu 11 and 12 is very effective for extinguishing a fire, p ly because it is fast-responsive but also because th outer secondary spray heads of the group form, when activated, "curtains" of fog spray which divide the respective group area from the rest of a larger space, such as a restaurant room, i.e. most of the fog spray remains within the area covered by the activated spray head group.

Figure 13 shows in section a releasing spray head 93. It has a spindle structure similar to the one described in connection with figure 3, so that a high pressure in the inlet line 107 does not prematurely damage or crush the release ampoule 104. When the ampoule 104 is weakened and releases the spindle structure to move downwards in the figure, t in coming from the line 107 has access to both th nozzles of the spray head 93 and to a branch line 108 which, as described in the foregoing, can lead to other spray heads or to a governing valve.

A similar spray head 93 can preferably be used

in the arrangement shown in figures 4 and 5, for the schematically drawn releasing spray heads 22. The schematically drawn spray heads 22a in figures 4 and 5 can be of the same kind as the spray heads 95-103 in figure 11.

Instead of, or in addition to, a pump unit as described in the foregoing, the drive unit for the extinguishing liquid can comprise hydraulic accumulators, preferably arranged as presented in the international patent application PCT/FI92/00193 or in the Finnish patent application 924752.

Claims:

1. Installation for fighting fire, with at least one releasing means reacting under the influence of an indication of fire, to initiate a fire extinguishing process, characterized in that said releasing means (3;22;91-94) is arranged to activate a group of spray heads (4;23;95-103).

2. Installation according to claim 1, characterized in that said group of spray heads (4; 23; 95-103) is a part of a larger system of individually activatable spray head groups.

3. Installation according to claim 2, characterized in that said groups of spray heads are arranged to overlap each other by means of the respective border spray heads (95,98,101,102), said border spray heads being activatable alternatively within either respective group.

4. Installation according to claim 3, characterized in that check valves (6;30;112) are arranged at said border spray heads (95,98,101,102) to prevent extinguishing liquid from flowing from an activated group of spray heads to an inactivated group of spray heads.

5. Installation according to claim 2, in particular for public spaces, such as a restaurant room, characterized in that the releasing means (3;91-94) and the group of spray heads (4;95-103) are arranged in an upper region of the respective room.

6. Installation according to claim 1 or claim 2, characterized in that at least one releasing means (22) is positioned in an upper region of the respective space and that at least one spray head (23) governed by said releasing means is positioned in the floor or in a wall of the respective space.

7. Installation according to claim 1 or claim 2,

characterized in that the releasing means is a spray head (3) arranged to directly distribute extinguishing liquid to a group of spray heads (4).

8. Installation according to claim 1 or claim 2, characterized in that the releasing means is a spray head (22; 91-94) arranged to indirectly, through a guide valve (26a; 26b), distribute extinguishing liquid to a group of spray heads (23; 95-103).

9. Installation according to claim 8, characterized in that said guide valve (26a; 26b) comprises

a valve body (31; 61) with an inlet (32; 62) connected to a liquid feed line (25; 105), an outlet (34; 64) connected to at least one releasing spray head (22; 91-94), and at least one outlet (35; 65, 66) connected to a group of spray heads (23; 95-103),

a spindle (36; 67) movable in the valve body, in sealed relation thereto, from a first position, closing connection from the valve inlet (32, 62) to the at least one outlet (35; 65, 66) to the group of spray heads (23; 95-103), to a second position, opening connection from the valve inlet (32; 62) to the at least one outlet (35; 65, 66) to the group of spray heads (23;95-103),

said spindle (36; 67) having end faces (45, 46; 76, 77) of equal area towards the valve inlet (32; 62) and the outlet (34; 64) to the at least one releasing spray head (22; 91-94), respectively, and an axial channel (44; 75) extending from end to end (45, 46; 76, 77),

said movement from the first position to the second position being at least partially effected by the pressure fall which occurs over the axial channel (44; 75) of the spindle (36; 67), when extinguishing liquid flows through the channel to a released spray head (22; 91-94).

10. Installation according to claim 9, characterized in that the spindle (36; 67) comprises a piston portion (39, 70) in sealed relation to the valve body (31; 61), a spring (41; 72) being arranged to act on one end face of the piston (39; 70) to keep the spindle in its first position, when there is no liquid flow through the axial channel (44; 75), the other end face (54, 81) of the piston (39; 70) being under the influence of the pressure in the the at least one outlet (35; 65, 66) to the group of spray heads.

11. Installation according to claim 10, characterized in that a throttled valve element (47) is provided in the axial channel (44) of the spindle (36).

12. Installation according to claim 10, characterized in that a branch line (108) is connected from at least one releasing spray head (93) to an outlet (66) to the group of spray heads (95-103) in order to upon release rapidly bring said other end face (81) of the spindle piston (70) under the influence of the operating liquid pressure.

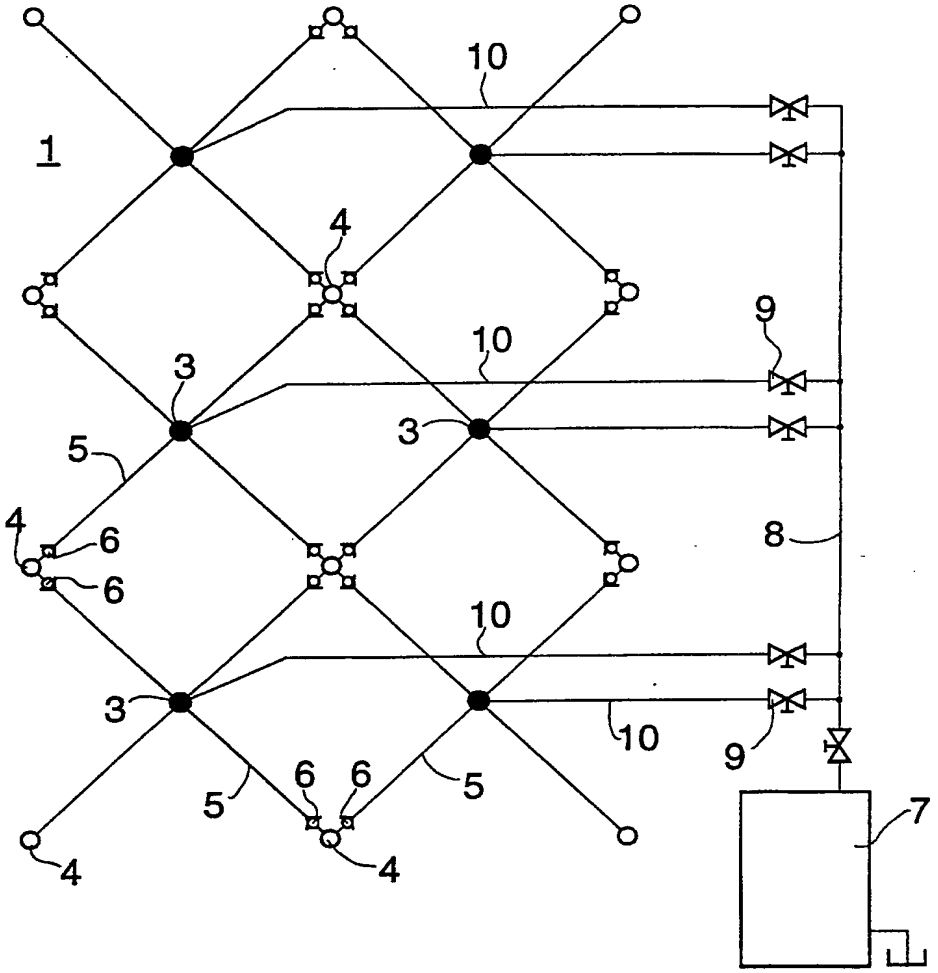


Fig. 1

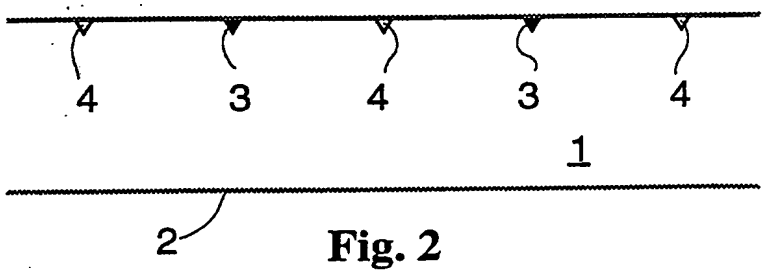


Fig. 2

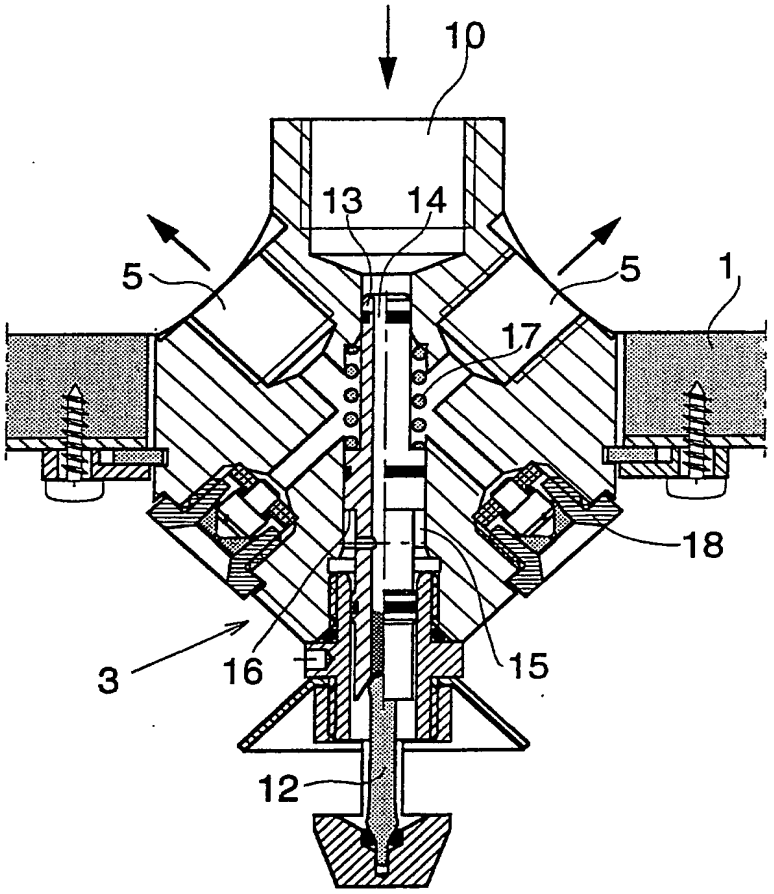


Fig. 3

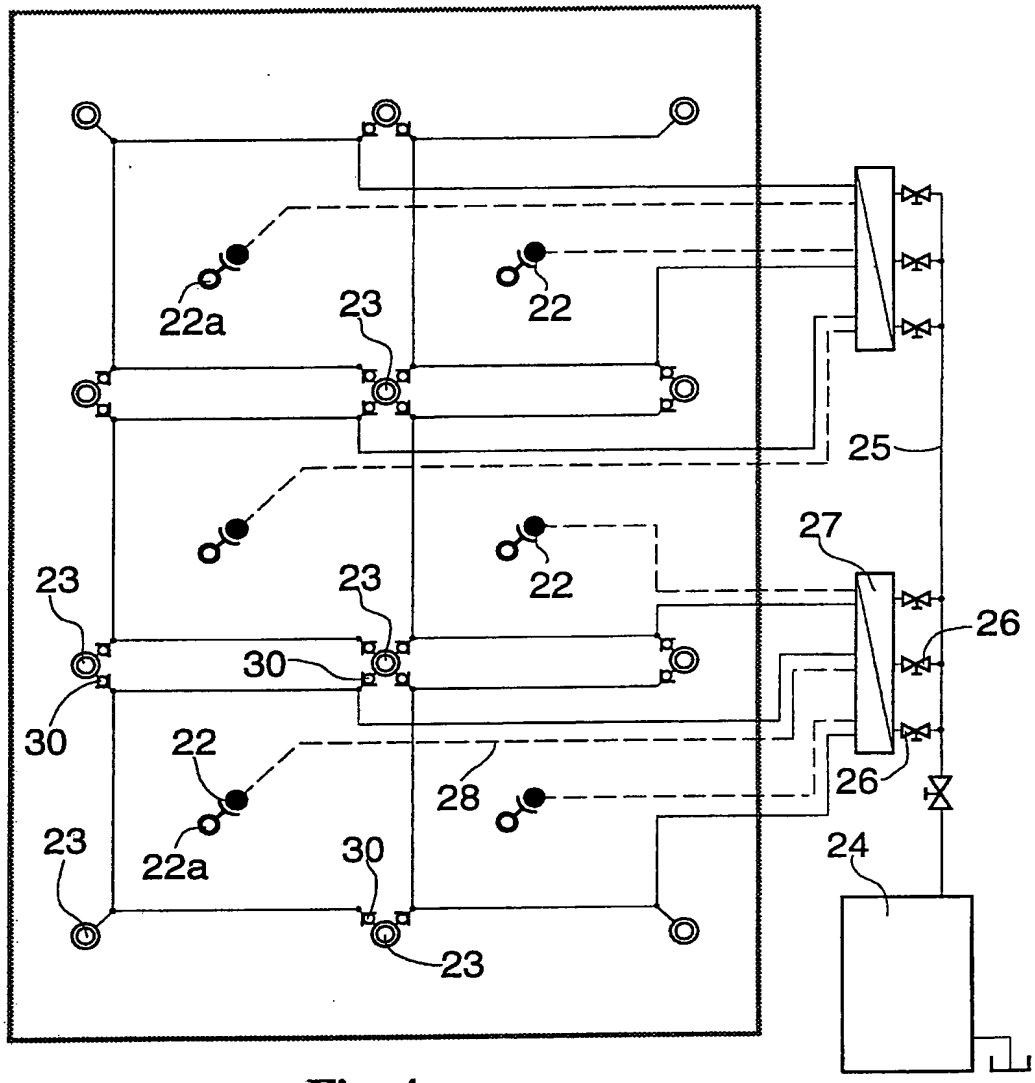

22a
23
22
25
27
23
23
22
26
30
30
22
28
26
23
22a
30
24
23

Fig. 4

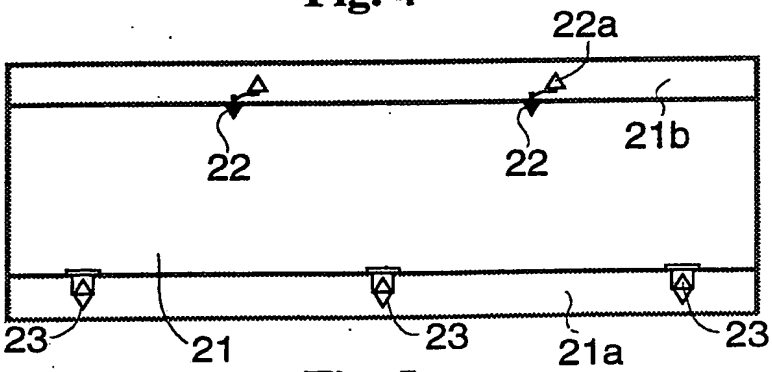

22a
22
22
21b
23
21
23
21a
23

Fig. 5

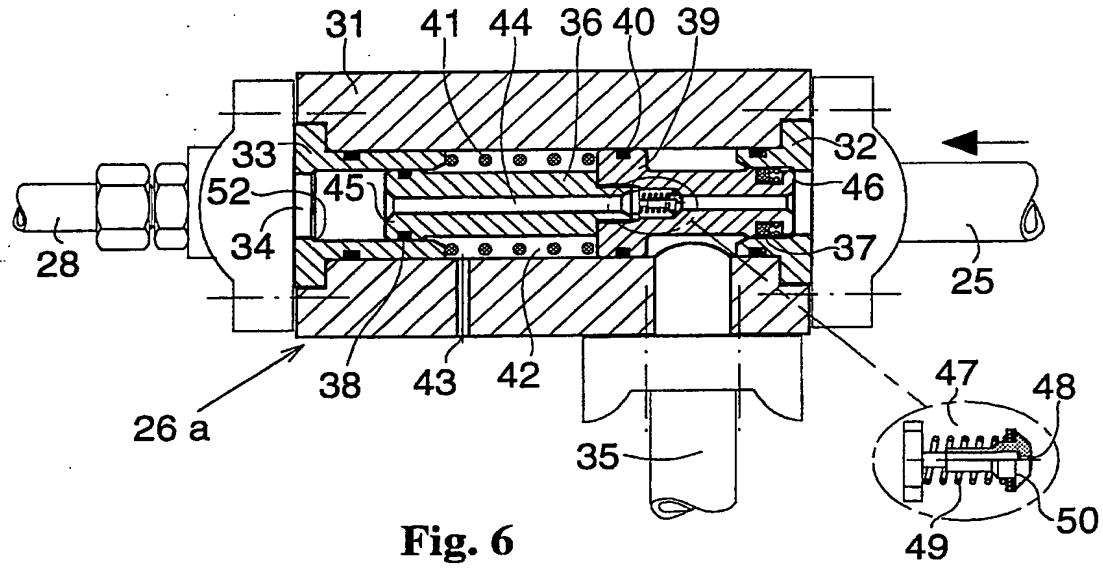

31
41
44
36
40
39
33
52
45
32
46
34
37
28
25
38
43
42
47
48
26 a
35
50
49

Fig. 6

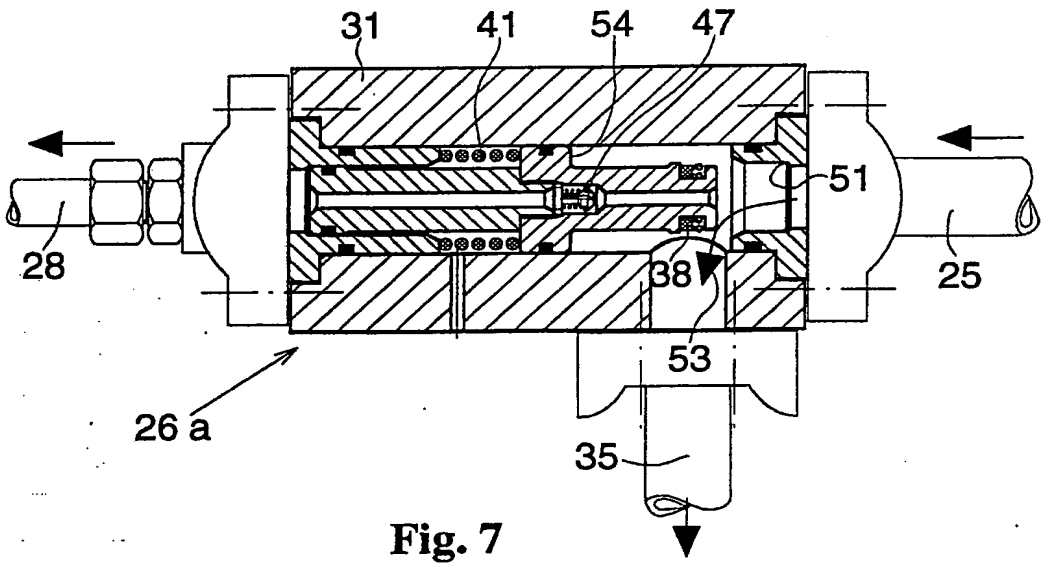

31
41
54
47
51
28
38
25
53
26 a
35

Fig. 7

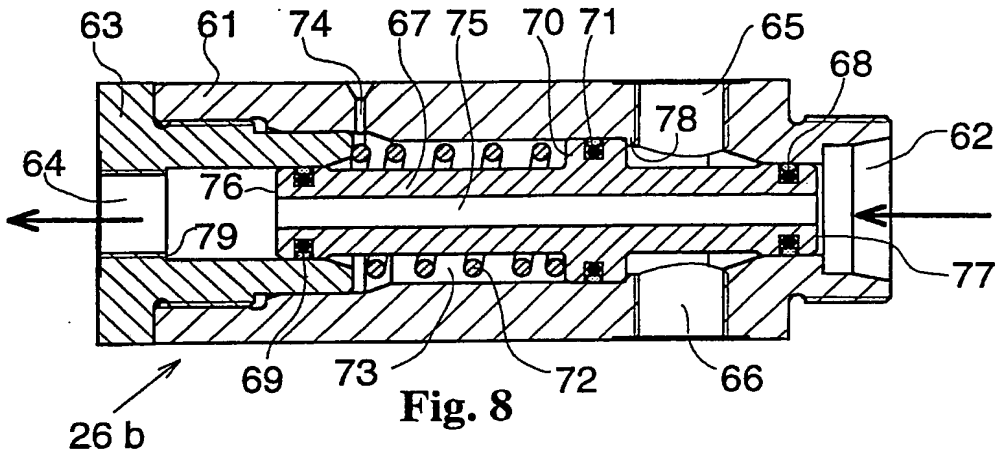


Fig. 8

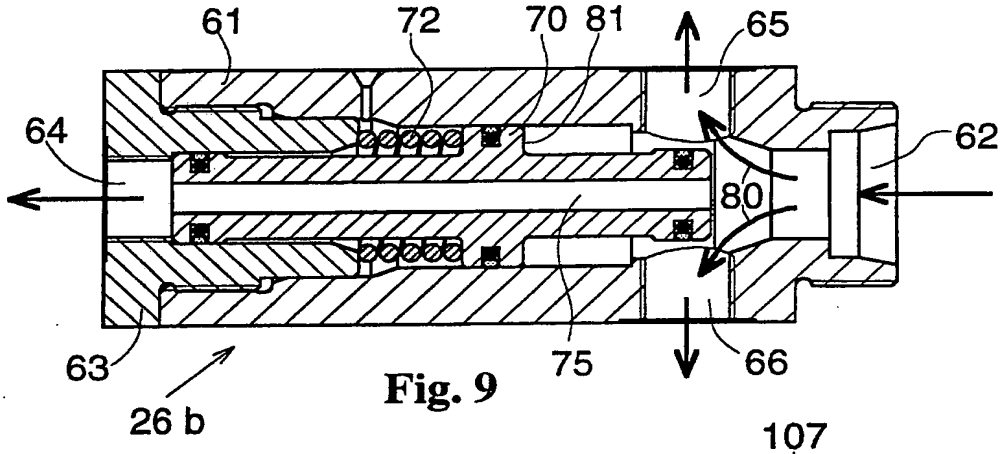


Fig. 9

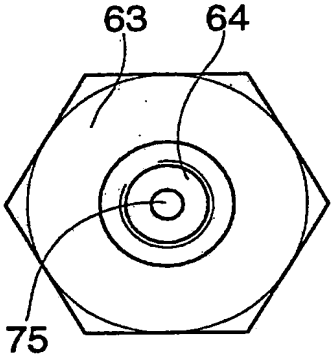


Fig. 10

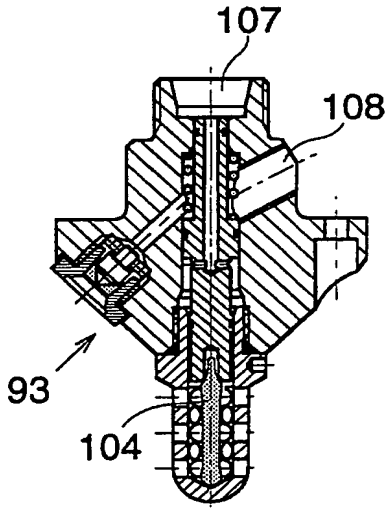


Fig. 13

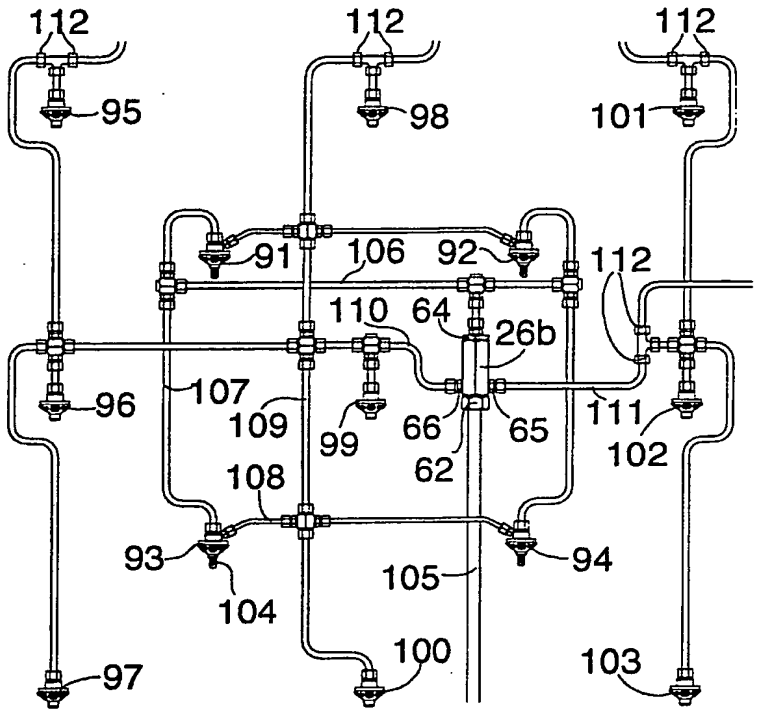

112
112
112
95
98
101
91
106
92
112
110
64
26b
96
107
109
99
66
65
111
102
62
108
93
94
105
104
100
97
103

Fig. 11

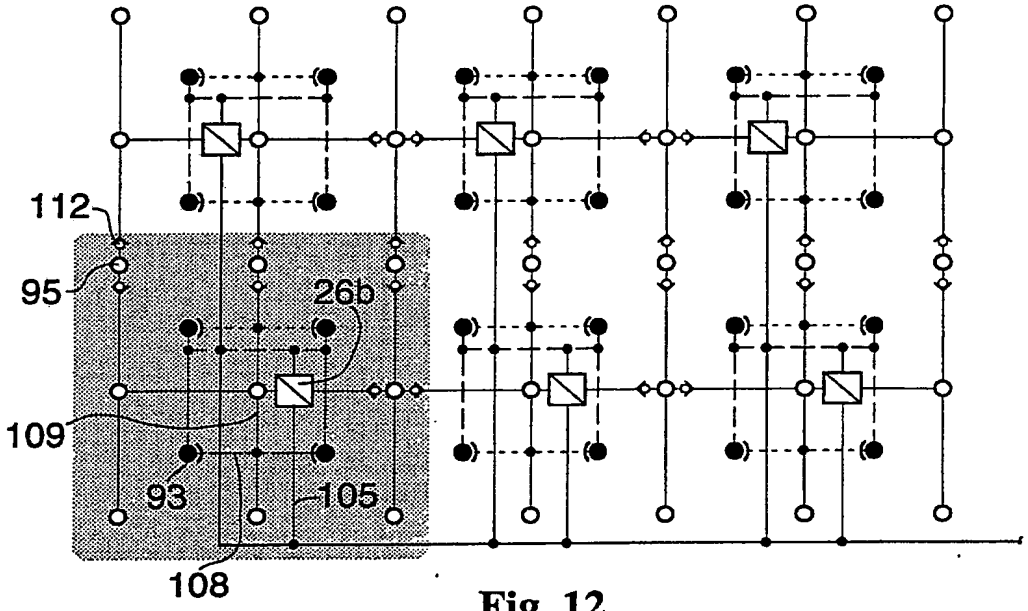

112
95
26b
109
93
105
108

Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 92/00316

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: A62C 35/58
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: A62C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB, A, 1474680 (CERBERUS AG), 25 May 1977 (25.05.77), page 2, line 89 - line 114; page 2, line 125 - line 130; page 3, line 3 - line 16	1,2,3
X	US, A, 2196592 (E. A. LOWE ET AL), 9 April 1940 (09.04.40), page 3, right column lines 39-52	1
A	--	6

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 March 1993	16 -03- 1993
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ulrika Öhman Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 92/00316

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 3702159 (W. L. LIVINGSTON), 7 November 1972 (07.11.72), column 2, line 40 - line 45	1,7

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☒ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.